Urban Agriculture Reaches New Heights Through Rooftop Gardening

"Rooftop simplified hydroponics" — a system used in the developing world — is being used in the Canadian city of Montreal. (Photo courtesy of Alternatives)

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In Montreal, as in other Canadian cities, many citizens would like to rent a small plot of land or join other growers to plant and grow vegetable crops cooperatively and then share the harvest. Long waiting lists for community gardens, however, thwart these modest ambitions.

In light of high demand and limited space for urban gardens, a Montreal-based development organization is experimenting with a gardening system called "rooftop simplified hydroponics" — a system adapted from the group's experiences in the developing world.

"Our goal at the moment is to develop a low-impact, low-input technology to grow food economically in cities," says Karen Templeton, a researcher at Alternatives, the Action and Communication Network for International Development. "The next step will be to find as many applications for it as we can."

Ultimately, Alternatives hopes that low-income residents can grow fresh vegetables on rooftops. Not only is the approach relatively inexpensive and easy, it will also take the environmental benefits of a green city to new heights.

The advantages of simplified hydroponics

Hydroponics, combining two Greek words that mean "water working," is a system that allows gardeners to grow more plants in a given space and that produces larger plants in a shorter time. Some advocates say the method improves the taste of garden crops too. What's more, the plants best suited to hydroponics — cucumbers, tomatoes, and leafy plants such as lettuce and fresh herbs — are the very ones treasured by many city dwellers.

Most hydroponics systems are comprised of beds known as “grow modules” that are filled with an inert “substrate,” or growing medium such as vermiculite or sawdust, which replaces soil to hold plant roots and moisture. A liquid nutrient solution runs through the beds to feed the roots. These roots are always kept moist, but are aired periodically so they don’t rot.

Commercial hydroponic systems can be intensive and expensive. In some cases, gangs of timers turn elaborate electric pumps and grow light systems on and off several times an hour. But hydroponic growing can also use simple technology. Yields from these “passive” systems are lower than from the intensive ones, but still better than a regular garden’s. Startup costs and maintenance are also lower. And unlike many larger, higher-tech hydroponic systems, the low-tech approach uses no electricity to water the garden.

Alternatives explores rooftop gardening in Montreal

Alternatives is exploring these kinds of low-technology approaches to hydroponics in Montreal, Canada’s third largest city.

The needs are clear. According to the city’s public health department, about one-quarter of Montreal’s population of 1.7 million is “poor” and 10% is “very poor.” In fact, the city has the largest proportion of low-income residents of any other major urban centre in Canada. Improving access to low-cost and good quality vegetables could help people save money and improve nutrition.

The environmental benefits of rooftop gardening are also clear: improved air quality and reduced greenhouse gas emissions, better storm water retention, and reduced heating and cooling costs to name a few.

“Ideally, we would like to see gardening projects in public spaces and on roofs that would be accessible to, and targeted at, people from disadvantaged groups. But to what point is this feasible? And with exactly what group? This remains to be seen,” Templeton says.

Seeking lessons from the developing world

During the winter of 2002, with the support of Canada’s International Development Research Centre (IDRC), Templeton expanded her knowledge of hydroponics in other countries. She worked with the University of Casablanca in Morocco and the Institute for Simplified Hydroponics in Mexico. The Institute believes hydroponics will enable many more landless peasants in the world’s expanding cities to feed themselves and earn a living from urban farming. Hydroponics are generally thought to quadruple yields over conventional gardening.

In Morocco, Templeton learned how student and community groups can organize gardens. For example, she saw how people manufactured growing beds from old tires, as well as illustrations of the economic and environmental benefits of simplified hydroponics. In Mexico, she learned how to use substrates, compost, and organic and inorganic nutrient solutions, among other techniques. In both countries, she saw how hydroponic gardening can reduce the water needed to irrigate plants by 90% — a critical factor for countries susceptible to drought.

Putting lessons into action

Drawing on what she learned from community groups in Morocco, Templeton returned to Montreal determined to find appropriate recycled materials for growing beds and substrates.

In the summer of 2002, Alternatives converted 50-gallon plastic olive barrels into growing beds by cutting them in half. Inside each lower barrel, a smaller, recycled olive drum held the nutrient solution. Every one to three days, a gardener poured the solution into the upper section of the growing bed to water the plants. The solution was dammed in the growing bed for 30 minutes while plants soaked up nutrients. The liquid was then drained back into the lower storage container.

After two growing cycles, researchers found that vegetables fed an organically derived nutrient solution grew best in a bed lined with a substrate that combined perlite — a volcanic rock commonly used by hydroponic growers — and compost. The plants also grew faster and produced greater yields than those grown in traditional soil-based urban gardens.

In the summer of 2003, Alternatives began experimenting with a wider range of crops, including tomatoes, ground cherries, and other leafy crops. They also sought to maximize the potential of typical Montreal urban spaces. Their research results include the following:

- New organically derived nutrient solutions have delivered higher nutrient concentrations in fruiting plants;
- A hybrid floating bed/solid substrate wick system, which is highly productive and low-maintenance, was successfully tested;
- Pipe systems using drip irrigation were adapted to balconies, walls, and the city's traditional spiral staircases.

Strengthening partnerships

Alternatives is now working to expand its partnerships, both within the city and internationally.

Toward the end of August 2003, Alternatives began working with the Jeanne Mance collective garden in Montreal, which tried out a hydroponics system. Initial scepticism was overcome and developed into enthusiasm and active participation. The collective used the system to test different nutrient sources, including its own innovative composting system.

“The positive reaction from this garden, and their interest in testing new ideas, has confirmed our belief that the collective garden model would be very suitable for a demonstration/research garden we hope to launch next year,” says Alex Hill, a project officer with Alternatives.

Alternatives has also teamed up with Engineers Without Borders (EWB), a student volunteer group at Concordia University in Montreal that has an interest in local and international community development. During the fall of 2003, a co-op student from EWB helped Alternatives continue research on systems design and nutrients. As well, the organization has developed an association with Santropol Roulant, a volunteer organization that delivers meals to disadvantaged citizens. Santropol Roulant has been cooking and delivering the harvest from the experimental garden and will participate next year in producing vermicompost for the nutrient solution. Alternatives has secured an agreement with Télé-université Québec (TélUQ) to use its rooftop space for a project in the summer of 2004. In addition, TélUQ researchers will lend their expertise to the research.

On the international front, Alternatives is sending team members for placements at both the University of Casablanca and the Institute for Simplified Hydroponics during the winter of 2004. The interns will continue their research and ultimately bring back lessons learned to benefit their work in Montreal.

Within five years, Alternatives wants its rooftop gardens to become a thriving space for budding urban gardeners in Montreal.

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